



US 20200183327A1

(19) **United States**(12) **Patent Application Publication**  
**El-Zehiry et al.**(10) **Pub. No.: US 2020/0183327 A1**(43) **Pub. Date: Jun. 11, 2020**(54) **VIRTUAL STAINING OF CELLS IN DIGITAL  
HOLOGRAPHIC MICROSCOPY IMAGES  
USING GENERAL ADVERSARIAL  
NETWORKS****G06T 7/00** (2006.01)**G06K 9/00** (2006.01)(52) **U.S. Cl.**CPC ..... **G03H 1/0005** (2013.01); **G03H 1/0866**  
(2013.01); **G06T 2207/30024** (2013.01); **G06K**  
**9/00127** (2013.01); **G03H 2001/005** (2013.01);  
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**ABSTRACT**(21) Appl. No.: **16/617,597**(22) PCT Filed: **Sep. 6, 2018**(86) PCT No.: **PCT/US2018/049702**

§ 371 (c)(1),

(2) Date: **Nov. 27, 2019****Related U.S. Application Data**(60) Provisional application No. 62/560,272, filed on Sep.  
19, 2017.**Publication Classification**(51) **Int. Cl.****G03H 1/00** (2006.01)**G03H 1/08** (2006.01)

A cell visualization system includes a digital holographic microscopy (DHM) device, a training device, and a virtual staining device. The DHM device produces DHM images of cells and the virtual staining device colorizes the DHM images based on an algorithm generated by the training device using generative adversarial networks and unpaired training data. A computer-implemented method for producing a virtually stained DHM image includes acquiring an image conversion algorithm which was trained using the generative adversarial networks, receiving a DHM image with depictions of one or more cells and virtually staining the DHM image by processing the DHM image using the image conversion algorithm. The virtually stained DHM image includes digital colorization of the one or more cells to imitate the appearance of a corresponding actually stained cell.

